Nursing Interventions in the Prevention of Febrile Seizures

Rayleen D. Swansen

BScN, University of Northern British Columbia, 1997

Project Submitted In Partial Fulfillment Of

The Requirements For The Degree Of

Master Of Science

In

Nursing

(Family Nurse Practitioner)

The University of Northern British Columbia

May 2008

Abstract

Febrile seizures are a common childhood problem occurring in two to five percent of children in Western Europe and the United States with a higher incidence reported in underdeveloped countries. Peak incidence occurs between 14-18 months of age. The author's experience when working with the Inuit population in the Eastern Arctic province of Nunavut suggests a high incidence of febrile seizures in young children although the statistics are not available regarding the incidence and prevalence. Community health nurses working in remote health centres are challenged by the uncertainty of which intervention is the most efficacious when treating these children during or following febrile seizures. This uncertainty results in inconsistent interventions, which creates stress and anxiety in both the community health nurses and parents. Despite their frightening presentation febrile seizures usually present as single benign incidents; however, once they occur, recurrence may be as high as 50 percent. Due to a lack of treatment guidelines on the prevention of febrile seizures in remote Nunavut communities interventions are often inconsistent. A systematic review of the literature and guidelines were conducted to respond to the question of whether increased dosages or prolonged use of pharmacological agents as compared to non-pharmacological interventions are more effective in preventing febrile seizures. Using the Stetler Model of research utilization as a framework to promote change recommendations for guidelines were developed.

Table of Contents

List of Tables

Glossary

Antipyretic interventions- For the purpose of this paper antipyretic interventions refers to the use of pharmacological medications such as acetaminophen or ibuprofen and non-pharmacological or physical methods such as fanning, cooling, and bathing in an attempt to reduce fever or prevent febrile seizures.

Benign- For the purpose of this paper benign describes a condition that doesn't threaten health or life, having no significant effect on health. Benign meaning there is not a threat to life or long-term health, essentially harmless (Baumer, 2004).

Causal relationship- For the purpose of this paper the meaning of a causal relationship describes the relationship between a fever and a febrile seizure. Specifically that a fever is the triggering mechanism leading to a febrile seizure.

Complex febrile seizure- For the purpose of this paper a complex seizure is defined as a prolonged seizure lasting longer than 15 minutes, occurring more than once in a 24-hour period, has focal signs, an may be associated with a neurological insult such as infection of the central nervous system (American Academy of Pediatrics, 1999).

Cytokines- For the purpose of this paper cytokines are defined as the proteins produced by cells of the immune system. These chemicals act as a defense mechanism by activating the immune system to fight infections. (Graneto, J., 2006; Mosby's Medical Dictionary, 2006; Tejani & Zempsky, 2006)).

Endogenous- For the purpose of this paper endogenous refers to produced from or occurring from with-in.

Epidemiology- For the purpose of this paper epidemiology refers to the study of disease or condition in any given population.

Evidence-based clinical practice- The process used by nurses to make clinical decisions about patient care or treatment using the best evidence available rather than basing decisions on personal opinions or common practice (which may not always be evidence based). Evidence based clinical practice involves integrating individual clinical expertise while taking patient preferences into consideration (The University of Minnesota, 2000).

Febrile seizure- For the purpose of this paper febrile seizure refers to a seizure that occurs in association with a febrile illness in children between the ages of six months to five years (Thiessen, R., 2006). Further definition includes that of the National Institute of Health (1980) stating that febrile seizure is an event in childhood that usually occurs in children three months to five years, is associated with fever but without evidence of neurological infection or other causes.

Fever- For the purposes of this project, fever was defined as 'an elevation of body temperature above the normal daily variation.

Fever without (apparent) source (FWS)- For the purpose of this paper fever without a source refers to a fever with no obvious cause.

Focal neurological signs- For the purpose of this paper focal neurological signs refers to findings on physical examination that may indicate an infection with-in the central nervous system such as a stiff neck or rash. These signs may also involve sensory organs such as visual and auditory (Tierney, McPhee, & Papadakis, 2006).

Focal seizures- For the purpose of this paper a focal seizure refers to a seizure that originates from one part of the brain. Symptoms depend on which part of the brain is affected. Typically, one part of the body or one side of the body will develop convulsive movements. Focal (or partial) seizures can also include sensory disturbances, such as smelling or hearing things that are not there. In an uncomplicated focal seizure, consciousness is not lost (Tierney, McPhee, & Papadakis, 2006).

Guideline- For the purpose of this paper guidelines are defined as a systematically developed tool that describes aspects of a patient's condition, and, care to be given. A good guideline makes recommendations about treatment, and care, and is based on the best available research, rather than opinion. Guidelines are used to assist both clinician and patient when making decision about appropriate health care for specific clinical conditions (National Institute of Health, 2008).

Heterogeneity- For the purpose of this paper heterogeneity refers to the differences or variations of results from individual studies that examine the same question (Melnyk & Fineout-Overholt, 2005).

Homogeneity- For the purpose of this paper homogeneity refers to the predetermined inclusion or exclusion of participants selected for a study. Participants are selected for studies on the basis of likeness and any differences in results occur due to chance (Melnyk & Fineout-Overholt, 2005).

Hypothalamic thermoregulatory center- For the purpose of this paper hypothalamic regulating centre is located in the hypothalamus and monitors body temperature via a negative feedback system to control body temperature (Mosby's Medical Dictionary, 2006).

Intervention- For the purpose of this paper an intervention is an action intended to benefit the patient, for example, drug treatment, surgical procedure, psychological therapy, etc.

Medevac- For the purpose of this paper a medevac is defined as the evacuation of a patient by air to the closest acute care facility or hospital.

Placebo- For the purpose of this paper placebos are defined as substances given to participants of a study and having no pharmacological effect. Sometimes known as sugar pills.

Simple febrile seizure- For the purpose of this paper a simple febrile is defined as a brief seizure lasting less than 15 minutes, occurs once in 24-hours in a child with fever and is not associated with a neurological infection (American Academy of Pediatrics, 1999).

Tepid sponging- For the purpose of this paper tepid sponging is defined as a traditional treatment for fever in which the patient is undressed and sponged with lukewarm water that is then allowed to evaporate.

Acknowledgement

I would like to take this opportunity to acknowledge the many individuals who have accompanied me on this my most recent journey through the pillars of education. I have devoted much energy and resources in fulfilling my dream of acquiring my master's degree. It has been a long journey, often accompanied with tears and frustrations but also many satisfying and fulfilling moments that I will treasure. The experiences over the past two years have provided me with the opportunity for enlightenment and goal attainment professionally as well as a deep sense of accomplishment and pride personally.

I would like to thank my professor and supervisor, Eileen Owen-Williams, for her support, guidance, and continual encouragement when my spirit plummeted.

To my committee member Alice Dupler for her guidance, prompt responses and your encouragement to the end.

A special thank you to Patryk Simon for bailing me out of the technicalities and computer glitches on so many occasions.

To my Mother, who has been an inspiration to me throughout my life for her strength of character, determination, strong constitution, and unwavering love. Her words of encouragement supported and guided me along this journey and I thank her.

To my daughter Ronna Pearson who graduated with honors herself, I am grateful for her support and proud to have such a wonderful daughter. To my daughter Robin and granddaughter Sandy whose presence is always in my heart and whose spirits surround me. I know they are watching over me would be very proud of this accomplishment.

To all my friends, fellow students, and nursing colleagues who offered support, words of wisdom, and encouragement, your friendship is treasured. I thank you.

Introduction

Residents of Canada's Eastern Arctic, the northern-most province of Nunavut, live in isolated communities several hundred miles from the nearest tertiary care facility. These communities are accessed by air only. Residents must rely on local health centres as their primary source of health care. Nurses working in an extended scope of practice are the primary care providers staffing these centres. The communities vary in size from a population of 300 to 1800 and are staffed by nurses according to population size. Staffing in the health centres may range from two to six registered nurses, whose expanded scope of practice includes the nursing management of acutely ill pediatric patients. It is the author's belief that one of the challenges of nursing within this population includes the management of children brought to the health centre during or following a febrile seizure.

The experience of working within this setting has confirmed the high incidence of febrile seizures among the Inuit pediatric population. Additionally, while working in this population the author had observed inconsistencies in the nursing management of febrile seizures such as, bathing, cooling, fanning, and the prolonged or intermittent use of antipyretics. These inconsistencies in management create a problem in that they may be potentially harmful to the child and also may cause increased discomfort. The prolonged or overuse use of antipyretics such as acetaminophen and ibuprofen may have the potential to cause hepatotoxicity (Joanna Briggs Institute, 2001) while bathing or cooling may cause shivering and may increase fever, additionally, these interventions are generally ineffective in reducing fever (Champi, C. & Gaffney-Yocum, P. 2001).

After searching the First Nations and Inuit Health Branch [FNIHB] guidelines the author was unable to locate guidelines for the nursing management of febrile seizures as a presenting

illness in the pediatric Inuit population. Without the direction of guidelines a variety of pharmacological and non-pharmacological treatments are utilized and community health nurses often experience fear and anxiety when a child presents with a febrile seizure because of uncertainty of which treatment method to utilize (Joanna Briggs Institute, 2001). In some cases an unnecessary and expensive decision is made to transfer the child by medevac to an acute care facility. Depending on the distance to the facility, the cost of such a transfer can run into thousands of dollars (Medivac North, personal communication, March, 2007).

It is important that treatment be standardized into evidence-based guidelines to:

1. Eliminate treatments that have no evidence supporting their effectiveness in the prevention or management of febrile seizures
2. Decrease the number of expensive, unnecessary, medevac transfers to acute care facilities
3. Decrease the anxiety of nurses caring for this common childhood occurrence
4. Decrease parental anxiety

Based on experience and background of the author, the following research question is posed: "Are pharmacological methods of preventing febrile seizures in children ages six months to five years more effective than non-pharmacological methods?"

The purpose of this project is to explore the various methods utilized in the prevention of febrile seizures, looking at the efficacy of pharmacological and non-pharmacological interventions, identify best practice guidelines, and make recommendations for care.

A systematic review of literature was completed. Additionally, a search for existing guidelines, and regional guidelines was undertaken and the Medical Health Officer of Nunavut and the transportation department for medevac tracking were contacted and consulted. The

experience of working in this population for ten years revealed a frequent occurrence of febrile seizure activity among young children.

The question this paper addresses has arisen from an inquiry as to the preventative measures or treatments employed by nurses working in northern remote nursing stations who attempt to reduce fever and prevent febrile seizures in children. The lack of evidence-based guidelines available for nurses working in these areas have led to inconsistencies in treatment. This project focused on simple febrile seizures. The purpose of this project was to explore various treatments or methods utilized in the prevention of febrile seizures in children. This paper will examine methods currently being used in the prevention and lowering of fever in an attempt to prevent febrile seizures and to recommend a best practice guideline.

Definition of Febrile Seizures

Febrile seizures are defined as seizures occurring in association with a febrile illness in children between the ages of six months and five years. Approximately three percent of all children are affected with a peak incidence occurring between 14-18 months (Thiessen, 2006). Febrile seizures rarely occur before nine months of age (Hampers, Thompson, Bajaj, Tseng, & Rudolph, 2006); however, they are the most common type of seizure in childhood. Esch, Steyerberg, Moll, Offringa, Hoes, & Habbema & Derksen-Larson. (2000) estimated that in three to five percent of children at least one febrile seizure occurs before the age of six years. It is important to differentiate febrile seizures with fever from complex febrile seizures secondary to central nervous system infections. Febrile seizures are relatively benign as compared to complex febrile seizures that have serious sequale, longer duration, and require further medical follow-up (Sadleir & Scheffer, 2007).

A simple febrile is a brief, generalized seizure lasting less than 15 minutes that occurs only once in 24-hours, in a child who is otherwise healthy (American Academy of Pediatrics 1999; Hopkins, 1991). The United States National Institute of Health, (1980) described a febrile seizure as "an event in infancy or childhood usually occurring between three months and five years of age, associated with fever but without evidence of inter-cranial infection or other defined cause for the seizure " (p. 1009). This definition of a simple febrile seizure excludes seizure with fever in children who have had previous febrile seizures (Waruiru & Appleton 2004). The International League Against Epilepsy is an association of physicians and other health care professionals whose mission is to provide quality care to those with epilepsy and other seizure disorders. They defined febrile seizure as a seizure occurring in childhood after one month of age, associated with a febrile illness, not caused by an infection of the central nervous system; a child who has no history of febrile illness or previous neonatal seizures or a previous unprovoked seizure, and who does not meet criteria for other acute symptomatic seizures (International League Against Epilepsy, 1989; Waruiru & Appleton, 2004). For the purpose of this project this definition has been adopted.

A search of the Health Canada website, First Nations and Inuit Health Branch (FNIHB) website, the Nunavut transportation department responsible for medevacs, and the medical records department of the Baffin Regional Hospital failed to reveal statistics on the incidence of febrile seizures specific to Inuit pediatric populations; however, based on experience and background it is the author's opinion that febrile seizures are not an uncommon event in this population. Additionally, there appears to be a familial incidence of febrile seizures in 25 to 40 percent of children treated for this condition in developed countries (Waruiru & Appleton, 2004). If a child has febrile seizures, his or her siblings have a 50 percent chance of also having febrile

seizures. If a parent had febrile seizures, this increases the likelihood that their offspring will be at risk for febrile seizures above 50 percent (2004). The genetic basis to this phenomenon is as yet unclear (Tejani & Zempsky, 2006).

Morbidity and Mortality

Febrile seizures are usually benign; they are not a threat to life or long-term health and are harmless in effect. In the general population of children aged six months to five years the risks for febrile seizures occurring are 2.7 to 3.3 percent (Baumer, 2004). The recurrence rate of febrile seizures following a child's first febrile seizure is as high as one third; of these, more than one half will occur within one year of the initial febrile seizure (Waruiru & Appleton, 2004).

In a British study conducted in the United Kingdom, 398 children with febrile seizures were followed up to ten years of age. After excluding 17 children with neurodevelopment difficulties prior to their first febrile seizure, 381 were followed. At the ten-year assessment only four showed any significant differences in academic achievement, intelligence, or behaviors. The children who had recurrent febrile seizures had outcomes similar to those who had only one episode of simple febrile seizures. Special schooling was required for those children having had a febrile seizure in their first year of life compared to those who had them later in life. However, these numbers were small, (67 vs. 4 of 265, $p = 0.02$) (Verity, Greenwood & Golding (1998). Simple febrile seizures have durations of less than 15 minutes, occur once in a 24-hour period, are generalized, and account for 80 percent of all febrile seizures (Thiessen, 2006). In contrast, complex seizures are recurrent in a 24-hour period, are prolonged, last longer than 15 minutes, are more focal, and account for 20 percent of all febrile seizures (American Academy of Pediatrics, 1996).

There appears to be no increased risk or incidence of mortality in children who have had febrile seizures. Additionally, there is no evidence of any association between febrile seizures and epilepsy or sudden infant death (Waruiru & Appleton, 2004).

Children with febrile seizures performed as well as other children in terms of academics, behaviors, and intellect at 10 years of age. Additionally, children with recurrent febrile seizures had outcomes similar to those with one seizure. (Crocetti, Moghbeli, & Serwint, 2001; and Verity, Greenwood, & Golding, 1998).

Nelson and Ellenberg (as cited in the American Academy of Pediatrics 1996) concluded that children who had simple febrile seizures were those who experienced generalized seizures lasting less than 15 minutes, did not recur within 24 hours, and occurred in otherwise healthy children (Tejani & Zempsky, 2006). These children had no evidence of increased mortality, hemiplegia, or mental retardation. It is unclear what the risk of developing epilepsy is following the occurrence of febrile seizures. The greatest risk (2-4%) of febrile seizures is recurrence (Waruiru & Appleton, 2004). It was concluded that simple febrile seizures are benign events with an excellent prognosis (The National Institute of Health, 1980).

Definition of Fever

In the literature reviewed the definition of fever varied. Stuijvenberg, Derksen-Larson, Habbema & Moll (1998) defined fever as greater than or equal to 38.5 degrees Celsius, while Waruiru and Appleton (2004) defined fever as any temperature above 37.5 degrees Celsius. Graneto (2006) defined fever as a rectal temperature of 38 degrees Celsius or higher. A temperature range of 37.6 degrees Celsius orally to 37.8 degrees Celsius or 38 degrees Celsius to 38.3 degrees Celsius rectally has been the fever definition used in best practice guidelines

(Joanna Briggs Institute, 2001). A search of the First Nations Inuit Health Branch Pediatric Clinical Practice Guidelines failed to produce a definition of fever.

Fever itself should be understood before further exploring the concept of febrile seizures. Although the exact mechanism of fever is unclear, it is a physiological and immunological response to an insult, usually a viral illness and less commonly a bacterial illness (Daoud, 2003). It is proposed that cytokines act on the thermoregulatory center in the brain to produce the physiological responses seen in fever such as chills, rigors and increased body temperature (Tejani & Zempsky, 2006). Some experts suggest that fever is essential in enhancing host resistance to infection and therefore, reducing fever may reduce the beneficial role fever plays in illness and may adversely affect the outcome of the illness (Meremikwu & Oyo-Ita, 2004).

A child's seizure threshold is low between the ages of six months to five years making the child more susceptible to many childhood infections to which they respond with high temperatures (Champi & Gaffney-Yocum, 2001). Endogenous pyrogens, the fever producing substance released by white blood cells, act on the hypothalamic thermoregulatory centre, and may contribute to febrile seizures (Dow & Lackey, 1999). A possible link may exist between endogenous pyrogens causing increased neuronal excitability. However, the mechanism remains unclear (Graneto, 2006; Tejani & Zempsky, 2006).

The precise clinical and pathological etiology of febrile seizures remains unclear, however, the general consensus remains that fever is a defense mechanism used by the body to kill pathogens by increasing body temperature (Crocetti, M., Moghbeli, N., Serwint, J. 2001; & Waruiru & Appleton 2004).

Geographic Incidence

The general population risk for febrile seizures among children ages six months to five years living in developed countries are two to four percent (Champi, & Gaffney-Yocum, 2001; Tejani & Zempsky 2006). Population studies conducted in Western Europe and the United States report a cumulative incidence of febrile seizures in children aged six months to five years at two to five percent and five to ten percent in India, 8.8 percent in Japan, and 14 percent in Guam. Reported data from developing countries are limited, this may be due in part because of the difficulty in differentiating simple febrile seizures from complex seizures secondary to malarial infections and partly because of lack of consistent reporting (Waruiru & Appleton 2004).

A review of the literature revealed no data on the incidence of febrile seizures among the Canadian Inuit population, which is the population of interest in this paper. The lack of statistics available may be partly due to Nunavut being a new province with new reporting procedures being implemented. As with any new province Nunavut has also seen a transient workforce of administrative personnel, the Medical Health Officer of Nunavut also verified this (Personal communication, February, 2007). A search of the Health Canada website revealed no statistics on the incidence of febrile seizures in Nunavut.

Chapter I

Theory

The framework of this inquiry is based on the Stetler Model of research utilization (Burns & Grove, 1997; Stetler 2001). This model was first developed in 1976 by Marram and Stetler as an approach to facilitate safe and effective use of research findings (Stetler, 2001). The model has evolved over the years but has remained grounded in concepts from a broad field of study exploring the application or utilization of knowledge (Stetler 1994). It acts as a structure for evaluating the appropriateness, feasibility, and manner of using research findings in an individual practitioner or group's practice. The updated model reflects a practitioner-oriented approach within evidence-based practice (Stetler, 2001). The catalyst of this model focuses on research utilization as an approach to decision making and the provision of evidence based nursing care. Research-based nursing interventions are needed to provide cost-effective, appropriate, quality, and consistent nursing care (Beyea & Nicoll, 1997).

Stetler (2001) identified six activity phases when using research: preparation, validation, comparative evaluation, decision-making, translation/application, and evaluation. Phase one, preparation, identifies the purpose and focus of the review. The literature may be reviewed to solve a problem, which could be clinical, managerial, or educational in nature. This step provides the basis for a policy, standard, or protocol, or may be used to prepare for an in-service program or other professional presentation. Phase two validation is the second step of the model; where the decision is made as to whether the information obtained from the review is relevant and applicable. Phase three, comparative evaluation, involves reviewing the findings of similar studies and deciding if they fit the population, environment, or problem in question. This step emphasizes the three R's: potential risk, resources, and readiness of participants. Phase four,

decision-making, occurs when the findings in the literature are either utilized or rejected. Phase five, translation and application; prepares for implementation of the recommendations or findings into practice, or how to apply the knowledge into practice. Phase six, evaluation, is the final step. This step determines what impact there has been on the patient or practice, and whether recommendations are being used as intended (Stetler, 2001).

Stetler (1994) identified four assumptions within the model. The assumptions were based on an understanding of research knowledge and include the organization involved, identity of the findings, combining of the findings, and the factors that influence the view of the research findings. The first assumption is that the organization may or may not be involved in an individual's research utilization. Findings from research occur informally at the individual practitioner level if that practitioner has the appropriate knowledge and continuously updates that knowledge. The second assumption is that research findings can be direct and observable, or indirect and difficult to identify. The use of findings can change one's way of thinking or influence a plan of action, and can also be used to persuade others to change their ways of thinking and behavior. It is hoped that the use of the recommendations from this project will influence the treatment decisions made by community health nurses when presented with a child having had a febrile seizure. The third assumption is that non-research based information can be combined with research findings in problem solving and decision-making. Within this project, non-research based information, such as the experience of the author working within the Inuit pediatric population, has been combined with research addressing the incidence of febrile seizures in this population.

The fourth assumption is that both internal and external factors influence an individual's or group's view and use of evidence (1994). In other words, the utilization of research is

influenced not only by the scientific criteria but also by the individual user's characteristics and environment. An example would be ineffective methods of treatment used in the management of febrile seizures merely because they have been used over the years.

Definition of Problem

From the author's experience, in the Eastern Arctic febrile seizures in children between the ages of six months to five years are common. Febrile seizures in children cause fear, anxiety and increased stress to both the community health nurses and the parents caring for these children. Inconsistent treatment and lack of guidelines are problematic. Various pharmacological and non-pharmacological methods are used in the treatment of children presenting with simple febrile seizures. These methods are often ineffective and have the potential to increase discomfort and possibly cause harm. Although guidelines exist related to use of pharmacological agents when caring for a child exhibiting fever, the Joanna Briggs (2001), NICE (2003), and NICE (2007) guidelines did not recommend the use of pharmacological agents either by increased dosages or prolonged use to prevent or minimize the risk of subsequent seizures. It is the author's opinion that practice guidelines would result in more consistent methods of treatment, less anxiety and stress to the community health nurse and parents, and reduce the frequency of costly medical evacuations (medevacs).

According to Hulshof & Hoenen (2006) practice guidelines are systematically developed statements designed to assist practitioners in making decisions that are specific to clinical practice situations. Guidelines are useful when there is a wide variety of existing practice interventions. They contain new practice information which could have an impact on the management of high risk patients; the smallest of changes in practice could have an impact on the high cost of patient management (Hulshof & Hoenen, 2006).

Research Question

Inconsistent interventions in the management of a child presenting with a febrile seizure in the remote communities of the Eastern Arctic causes fear, stress and anxiety in the community health nurses and parents. These inconsistent interventions have the potential to cause harm and increase discomfort and have prompted the inquiry into the best intervention of treatment in the management of febrile seizures. In an attempt to determine which treatment has the greatest efficacy in the management of febrile seizures, the following research question is addressed, "Do increased dosages or prolonged use of pharmacological agents result in decreased incidence of seizures as compared to non-pharmacological methods such as fanning, bathing, and sponging?"

Description of Project

Inuit children between the ages of six months and five years living in the Eastern Arctic province of Nunavut are the focus population of this paper. A systematic review of the literature was conducted for the purpose of determining various methods utilized in the prevention and management of febrile seizures. Best practice guidelines were identified; from these guidelines recommendations for the care and management of this childhood occurrence were made for future review by the First Nations and Inuit Health Branch of Canada (FNIHB). Non-pharmacological methods of treatment such as bathing, sponging, and fanning will be compared to pharmacological treatment with antipyretics such as acetaminophen and ibuprofen. In addition, the absence of any treatment in regard to effectiveness in the reduction of fever and prevention and management of febrile seizures will be addressed.

Search Process

The goal of the literature review was to identify articles related to febrile seizures and pharmacological and non-pharmacological interventions used in their management and prevention.

This systematic review of literature included computerized searches of online databases including CINHAL, Joanna Briggs Institute, Medline (EBSCO), Cochrane Databases of Randomized Controlled Trials, and OVID. Manual searches of reference lists were also included in each article reviewed (Table 1).

Other searches included an electronic search of First Nations and Inuit Health clinical practice guidelines and the Registered Nurses Association of Ontario Best Practice Guidelines. This search was based on phase I of the Stetler Model which recommends that a mixed review of research be utilized in order to gain valuable insights into the identified problem. The user can then differentiate the research and make a selection based on the relevancy of the findings (Stetler 2001).

The following keywords used to search were: 'febrile', 'fever', 'convulsions', 'seizures', 'fever and Inuit children', 'acetaminophen', 'paracetamol', 'ibuprofen', 'Tylenol', 'simple febrile seizure', 'sponging', 'bathing', 'fanning', and 'Stetler Model'.

Three systematic reviews were retrieved from the Cochrane Database. One systematic review was retrieved from the Joanna Briggs Institute and Six guidelines were retrieved, one from the Joanna Briggs Institute and five from Ovid. CINAHL and Medline searches revealed ninety-nine articles.

Table 1

Database Search Results

Source	Number found	Number Included
Cochrane Database of Systematic Reviews	3	2
CINAHL	36	17
Medline (EBSCO)	63	19
Joanna Briggs	2	2
Ovid	6	4

Inclusion Criteria

Randomized control trials, quasi-randomized control trials, practice guidelines, and systematic reviews were reviewed using the above search methods. Studies included in this review involve children between the ages of six months to five years who had a simple febrile seizure or who were at risk of febrile seizures, and those studies that addressed post seizure management of children presenting to a healthcare facility following a simple febrile seizure. In addition, studies discussing non-pharmacological methods to reduce fever such as bathing, fanning, sponging, and hydration related to fever management; articles discussing fever management in children ages six months to five years, and articles discussing pharmacological interventions such as the use of acetaminophen, ibuprofen, and benzodiazepines were included. The definition of febrile seizure in these articles remained consistent while the definition of fever

varied slightly. Studies included randomized control trials and randomized double blind trials from all English speaking countries conducted from 1996 to 2007.

Exclusion Criteria

Exclusion criteria include those articles related to seizure with a known etiology or an etiology involving the central nervous system such as epileptic seizures. Articles related to children on anticonvulsant medications were excluded as were those referring to children outside the age range of six months to five years. In keeping within the Stetler Model framework, research articles that were deemed to have insignificant or irrelevant results were excluded.

A total of 63 articles out of ninety-nine were rejected based on the above exclusionary criteria. The primary reasons for exclusion of research articles were age of the population studied, pre-existing neurological etiology, and seizures of a complex rather than simple nature. Studies included randomized control trials, randomized double blind trials, retrospective studies, and prospective studies from all English speaking countries completed from 1996 to 2007. One systematic review was excluded because of age variances and 2 guidelines were excluded, one because of it being outdated (1994) and one because recommendations were replaced by a more current guideline.

Chapter II

Review of Literature

Several studies were identified in the systematic review that addressed management and prevention of febrile seizures in children. In this chapter the author will discuss these studies. Both pharmacological and non-pharmacological interventions in the management of children

presenting with simple febrile seizures were addressed and discussed in the systematic reviews and guidelines reviewed for this paper.

Pharmacological Treatment

Meremikwu & Oyo-Ita (2004) conducted a systematic review of randomized and quasi-randomized controlled trials to assess the effects of acetaminophen in treating fever. This review examined pharmacological variables comparing children treated with acetaminophen, placebo, or no treatment, and non-pharmacological cooling methods describing 12 studies (n = 1509). Of the 12 trials, seven included children between the ages of six months and five years. Two compared acetaminophen and placebo, and four examined non-pharmacological methods of bathing and cooling. Outcomes included fever clearance, a temperature of less than 37.5 degrees Celsius, and no febrile seizures after antipyretics and physical methods were started; secondary outcomes were the proportion of children without fever by the first, second, and sixth hour after starting treatment (2004).

In randomized, double-blind, placebo-controlled study that compared acetaminophen with a placebo in children ages six months to five years (n = 225), the primary outcome of no fever was observed in the acetaminophen group and occurred at 34.7 hours (n = 123) while the time to no fever in the placebo group occurred (n = 120) at 36.1 hours. The authors reported no statistically significant difference and no standard deviation was given. No febrile seizure was reported in the acetaminophen group or the placebo group. Dosages of acetaminophen varied from 10 to 15 mg/kg given in various numbers of doses; one to two doses (n = 92) three to five doses (n = 75) and greater than six doses (n = 56) were administered every four hours among three groups. The author's reported no statistically significant differences in duration of fever or other symptoms among the groups, however, the statistics were not reported (Kramer, Naimark,

Roberts-Brauer, McDougall , & Leduc, 1991). This study signifies that prolonged use of acetaminophen has little effect on duration of fever and subsequently on the prevention of febrile seizures.

Using serially numbered envelopes to randomize, a quasi-randomized controlled trial of children (n = 130) six months to five years of age received acetaminophen 10-15 mg/kg every four hours (Steele, Tanaka, Lara & Bass 1970). Participants excluded were those who had received an antipyretic within four hours prior to entry into the study. The authors reported significantly (CI_{95} = 1.39-334.01) more children in the acetaminophen group (17/25) as compared to the placebo group (0/15) were without fever by the second hour following initiation of treatment; again, no febrile seizures were reported.

Stuijvenberg, et al. (1998) studied ibuprofen verses placebo given every six hours to prevent febrile seizure. The primary outcome was the first recurrence of a febrile seizure. In an intention to treat analysis, all first recurrences were considered regardless of study medication compliance, and a pre-protocol analysis which was limited to those recurrences that occurred in the context of the study medication compliance were performed. Kaplan-Meier curves and Cox regression were used for statistical analysis. This randomized double blind trial involved 230 children aged one to four years with at least one risk factor for febrile seizure. The children were randomly assigned to ibuprofen syrup or placebo groups. Either ibuprofen 20 mg/ml at 5 mg/kg per dose, or a matching placebo, was administered every six hours during episodes of fever (temperature > 38.5 degrees C. rectally) until the child was afebrile for 24 hours. Febrile seizures and rectal temperature were identified as outcomes. These children, (n = 230, 119 in the placebo group and 111 in the ibuprofen group) were followed over 18 months. Parents were to notify an investigator, who was available by telephone 24-hours a day, when a fever occurred to report on

the recurrence of a febrile seizure. During the follow-up period, 555 fevers were reported in 194 children; 94 children in the ibuprofen group reported 271 episodes of fever while 100 children in the placebo group reported 284 episodes of fever. Among all children 67 had a febrile seizure recurrence; 31 were in the ibuprofen group and 36 in the placebo group. The 18-month recurrence probabilities were 32% and 39 % respectively. The recurrence risk in the ibuprofen group was 0.9 (95% CI_{95}= 0.6-1.5) times the recurrence risk in the placebo group. Of these, 30 first febrile seizures occurred even though compliance with the medication protocol was verified. The authors believed that the intermittent use of ibuprofen makes a difference, however, the results indicated that it is unlikely. Parental non-compliance such as unreported use of other antipyretics and timing of temperature taking may have been factors in the results. Temperature was taken every six hours just prior to the next dose of ibuprofen. The authors felt that had the temperature been taken earlier it may have shown a stronger antipyretic effect. If adequate reduction of fever prevents seizures then prevention may be possible using a stronger dose, perhaps 10 mg/kg of ibuprofen rather than 5 mg/kg as given in this study (Stuijvenberg, Derksen-Lubsen, Steyerberg, Habbema, & Moll, 1998).

A previous study (Esch et al., 2000), examined ibuprofen versus acetaminophen. The objective was to estimate the potential preventive effect of antipyretics on the recurrence of febrile seizures. This study was a prospective study of children aged 10 to 36 months, with 109 in the treatment group, and 103 in the control group. In an intention to treat analysis, the risk of any recurrence and the number of recurrences per fever were compared between the groups. Additionally, on-treatment analysis compared the number of recurrences of febrile seizures per fever between the two groups. The Mantel-Haenszel procedure estimated the odds ratio (OR), and the Cox regression estimated the hazard ratio (HR). The hazards ratio of any recurrence in

the treatment group compared with the control group was 1.1 (95% CI_{95} = 0.7-1.8). In the treatment group the recurrence rate per fever was 15 % compared to 12 % in the control group (OR, 1.2, CI_{95} = 0.7-2.3). In the on-treatment analysis the recurrence risk of febrile seizure was estimated at 6.9 % compared to 12 % in the control group (OR, 0.5, CI_{95} = 0.2-1.3). This study concluded that antipyretic treatment might have little or no preventative effects on the recurrence of febrile seizures. Some reduction of the risk may be acquired if the fever is noticed at onset and treated with antipyretic medication, however, this is only under optimal circumstances (Esch et al., 2000). Ibuprofen showed a stronger fever reducing effect as compared to acetaminophen; however, both have been shown to be safe and effective antipyretic drugs in the treatment of fever in children; and are safely administered for comfort during periods of illness. Furthermore, this study (Esch et al., 2000) identified a lack of evidence that antipyretics reduced the incidence of febrile seizures.

A systematic review of five studies (Purssell, 2000) investigated the hypothesis that prophylactic use of acetaminophen and ibuprofen reduces the incidence of febrile seizures in children. Because of the heterogeneous collection of these studies the authors considered it inappropriate to conduct a quantitative analysis and chose a narrative review of the results.

One of the five randomized double blind studies (Camfield, Camfield, Shapiro, & Cimmings, 1980) in Purssell's (2000) systematic review, compared the anticonvulsant phenobarbital with a placebo in children ages six months to three years who had previously been seen for a febrile seizure. Parents of the children in the placebo group were given instructions for antipyretic measures such as reducing clothing, increasing fluids, and giving acetaminophen. Children were followed for 12 months or until the recurrence of a febrile seizure. The authors concluded that over this period of time there was no reduction in the recurrence of febrile

seizures in either the anticonvulsant group or the placebo group. A limitation of this study was that it investigated the anticonvulsant with no control for the antipyretic.

Another study (Sunami, Hayashi, & Endo, 1990) in Purssell's (2000) systematic review examined approximately 11,000 Japanese children aged 0 to 36 months over a three year period from 1983 to 1986. No allocation was identified. The approach taken was to interview parents at each regular physician visit about the occurrence of febrile seizures. It was noted that there was a reduction of febrile seizures, which occurred between 1984 and 1985. The authors attributed this to the introduction and availability of acetaminophen suppositories, although they stated social and environmental factors were also identified as having had an impact in the reduction. They did not identify what these factors were. The author's reported a fall of eighty-eight percent in the number of febrile seizures reported among the eligible children. The lack of a placebo group made it impossible to evaluate the efficacy of acetaminophen as compared to the intervention.

A randomized control trial (Schnaiderman, Lahat, Sheerer, & Aladjem, 1993) investigated the regular administration of acetaminophen versus sporadic administration. Children (n = 104) aged six months to five years who had been admitted to a hospital following a febrile seizure were randomly assigned to either a group receiving regular dosing of acetaminophen, (n = 53) the intervention group, or to the control group (n = 51) who received sporadic dosing of acetaminophen. The sporadic dosing was contingent on having a fever above 37.9 degrees Celsius. The outcome identified was recurrence of febrile seizure. The intervention group received regular four-hour doses of 15-20 mg/kg of acetaminophen as compared to the control group that received sporadic doses when temperatures exceeded 37.9 degrees Celsius. This regime continued for 12 to 18 hours after a child's temperature returned to normal or four days following treatment, whichever was later. The incidence of febrile seizures and temperature

values were similar in both groups despite the large acetaminophen doses administered to the control group. Four children in the intervention group (7.5%) had a recurrence of febrile seizure within 24 hours of admission compared to five children (9.8%) in the control group. The author's reported the overall number of febrile seizures and their distribution among the two groups was not statistically different.

These results showed no advantage in receiving regular acetaminophen as compared to sporadically administered acetaminophen to children with febrile seizures to decrease fever or prevent the recurrence of febrile seizures (Schnaiderman et al., 1993). This study (Schnaiderman et al., 1993) was limited in that there was no placebo group to properly evaluate interventions (Purssell, 2000). Also questionable in this study were the higher doses of acetaminophen, up to 105 mg/kg. Suggested doses of 80 mg/kg/day have been shown to be effective in reducing fever in children who experienced a febrile seizure; therefore, the failure of regular doses of acetaminophen given to prevent the recurrence of febrile seizures may not be due to the insufficiency of the dosage (El-Radhi & Banajeh, 1989). A more aggressive use of acetaminophen in larger doses is unlikely to be more effective, and the safety of this high dose is questionable. The difficulty parents may have adhering to the every four-hour administration regime might have made compliance unlikely. This study identified a group of children having a first febrile seizure that nurses came in contact both as inpatients and outpatients. For these children, there appeared to be no benefit to the routine administration of acetaminophen to prevent a recurrent febrile seizure (Purssell, 2000).

The studies in the Purssell (2000) systematic review varied with the population size, method of recruitment, and place of observation making the situations of the population different (Purssell, 2000). Sunami, et al. (1990) included a large number of children observed in routine

clinics in Japan while Schnaiderman et al (1993) examined effects of regular versus sporadic dosing of acetaminophen in a smaller number of children in the hospital setting.

Pharmacological Versus Physical Methods

In comparing acetaminophen with physical methods such as sponging, fanning, and unwrapping, Meremikwu & Oyo-Ita, (2004) identified six trials of which two had adequate data for meta-analysis. Of the six, four met the age criteria of this project. Fever clearance time was examined in these four randomized control trials of the aforementioned systematic review (Meremikwu & Oyo-Ita, 2004) comparing acetaminophen to the non-pharmacological method of sponging.

In a Turkish study (Aksoylar, Aksit, Caglayan, Yaprak, Bakiler, & Cetin, 1997) 224 children aged six to 60 months were randomized to either an acetaminophen or sponging group. The method of randomization in this study was not specified. The measured outcome was a mean temperature drop. The authors reported a significant difference ($p = < 0.001$) between the acetaminophen group compared to the sponging group; however, the allocation of participants was not specified. The second study (Agbolosu, N., Cuevas, L., Milligan, P., Broadhead, R. L., Brewster, D., & Graham, S. M., 1997) randomized 80 Malawi children aged six to 60 months. Forty were allocated to the acetaminophen group and 40 to the sponging group. The outcome measure of this study was also a mean temperature over time. There was no significant difference reported between the acetaminophen group and the sponging group in the primary outcome of fever clearance, however, there was a significant difference ($p = < 0.001$) in the primary outcome of febrile seizure.

The third randomized control study (Freidman & Barton, 1990) included 73 children aged six months to four years in the United States and compared acetaminophen to sponging.

The allocation of the groups was not identified. This study reported a statistical difference (p = 0.03) in fever clearance between the groups but no significant difference in the primary outcome of febrile seizure.

The fourth study (Kinmonth, A.L., Fulton, Y., & Campbell, M., 1992) in the Meremikwu & Oya-Ita (2004) systematic review compared 52 British children, aged three months to five years. Participants were evenly allocated (n = 26) to the acetaminophen group and the sponging group. This study also identified the outcome of mean temperature drop. No statistically significant difference (CI_{95} = 0.33-1.6) was noted in the sponging group (n = 26) as compared to the acetaminophen group (n = 26).

Primary outcomes assessed in all four studies were febrile seizure and fever clearance time. A significant difference was reported in the fever clearance time between children receiving acetaminophen as compared to those being sponged, however, time varied. One febrile seizure was reported among the sponging group (Meremikwu & Oyo-Ita, 2004).

The implications for practice from this systematic review (Meremikwu & Oyo-Ita, 2004) conclude that evidence is weak and inconsistent in the use acetaminophen. It was emphasized that these results did not mean that acetaminophen was ineffective but rather that the number of studies were too few to conclude a positive therapeutic effect in its use as compared to a placebo in reducing fever to prevent febrile seizures (Meremikwu & Oyo-Ita, 2004).

A systematic review (Watts et al., 2001) conducted in 2001 examined ten randomized and quasi-randomized studies which included 1026 non-critically ill children with a fever, aged three months to 16 years with fever. This study looked at children in the United Kingdom, the United States, Canada, Singapore, Thailand, Turkey, Malawi, and Australia. Published and unpublished studies in the English language were examined. These studies had been presented or

published over the period of 1970 to 1997. Subgroups who had received outdated interventions such as aspirin, ice water, and alcohol sponges were removed, leaving 821 children. This systematic review provided information on the effectiveness of administering antipyretics as compared to physical methods in reducing fever in children and examined four outcomes: reduction or prevention of fever, prevention of febrile seizure, increased comfort, and decreased parental anxiety. Inclusion criteria included non-critically ill children with fever of 38 degrees C. to 41 degrees C. rectally. Interventions included the administration of antipyretics, hydration maintenance and external cooling methods (Watts et al., 2001). The comparisons between interventions were sponging compared to acetaminophen only, sponging compared to acetaminophen and sponging, and acetaminophen compared to antipyretic and sponging. The following paragraphs describe these studies and the reported findings.

Acetaminophen Compared to Sponging

Six studies (Agbolosu, et al., 1997; Aksoylar et al., 1997; Brandts, 1997; Freidman & Barton, 1990; Kinmonth, 1992; & Steele, 1970;) examined the use of acetaminophen only as compared to sponging. All six reported acetaminophen alone reduced the fever more compared to sponging; however, only three studies (Agbolosu, et al., 1997; Freidman & Barton, 1990; Aksoylar et al., 1997) reported any statistical ($p = <0.05$) data. The others did not report whether the results were statistically significant.

Acetaminophen and Sponging Compared to Sponging

This comparison of acetaminophen plus sponging as compared to sponging alone included five studies (Freidman & Barton, 1990; Hunter, 1973; Kinmonth, et al. 1992; Steele et al., 1970; Teo, J., Rahim, N., Fong, V., Koon, S., Mai, T., Yap, J., 1998) comparing acetaminophen and sponging to sponging only. All five studies found the combination more

effective than sponging alone (Watts et al. 2001) Four (Freidman & Barton, 1990; Kinmonth et al., 1992; Steele et al., 1970; Teo et al., 1998) of the five research teams reported a statistical significance ($p = 0.003$); while one (Hunter, 1973) did not include a statistical analysis. All five studies found the combination more effective than sponging alone (Watts et al., 2001).

Acetaminophen and Sponging Compared to Acetaminophen

This comparison included eight studies (Friedman, A. D., & Barton, S.L., 1990; Hunter, 1973; Kinmonth, 1992; Mahar, A. F., Allen, S. J., Milligan, P., Suthumnirund, S., Chotphayasunondh, T., & Sabchareon, A., et al. 1994; Newman, J., 1985; Sharber, 1997; Steele, et al. 1970; & Teo et al, 1998) comparing acetaminophen plus sponging to antipyretic alone. In three of the eight studies (Friedman & Barton, 1990; Mahar, 1994; Teo, 1998) the research team reported a significant difference ($p = < 0.003$, $p = < 0.001$, and $p = < 0.05$ respectively) Steel, et al. (1970) used a rating scale of good, fair, and poor. A good rating was reported in this group. Three did not report a significant difference and one (Kinmonth, 1992) did not report on the statistical significance (Watts et al., 2001). In this systematic review (Watts et al., 2001) examining a total sample of 821 children, one febrile seizure (0.12%) was reported (Agbolosu et al., 1997; Watts et al., 2001) during the study. The child had a temperature of 39.7 degrees Celsius, was in the sponge only group, and experienced a seizure 90 minutes after being sponged (Watts et al., 2001).

This systematic review (Watts et al., 2001) provided information on the effectiveness of three categories of interventions: the use of antipyretics, cooling methods, and a combination of the two. Outcomes used to measure these interventions included preventing febrile seizure, comfort and irritability. The evidence was insufficient or not available to form conclusions. For two of the outcomes measured, prevention of febrile seizures and increased comfort there was

either insufficient evidence or no evidence on which to base conclusions. In seven studies (Agbolosu, et al. 1997; Aksoylar et al., 1997; Freidman & Barton, 1990; Hunter, 1973; Steele et al., 1970; Kinmonth et al., 1992; & Teo, et al., 1998) the fourth outcome; reduction of fever, acetaminophen alone reduced the temperature more (Watts et al., 2001). However, only three of these studies (Agbolosu, et al., 1997; Aksoylar et al., 1997; Freidman & Barton, 1990) reported a statistical difference following the administration of acetaminophen. One study (Teo et al., 1998) did not report a statistical difference; the remaining three did not report whether or not results were statistically different. One of the studies (Kinmonth et al., 1992) addressed parental care and recommended the need for parental education while others identified the lack of available literature that suggests administering antipyretics reduces the incidence of febrile seizures in children (Watts et al., 2001).

The Joanna Briggs Institute (2001) examined ten randomized and quasi-randomized studies, which included children between the ages of one to five years (n = 821) with equal male to female ratio. The institute grouped the outcomes of the reviews, identifying that outcomes can have more than one effect. The outcomes identified were comfort of child and prevention of febrile seizures. The results of the systematic review were presented as a narrative and therefore the research team acknowledged using caution when interpreting the results.

Pharmacological Versus Physical Methods

Interventions examined in this author's review were similar to the previous studies mentioned in this paper, including acetaminophen compared to sponging, acetaminophen and sponging compared to sponging alone, and, acetaminophen and sponging compared to acetaminophen alone.

Acetaminophen Compared to Sponging

In seven studies (Agbolosu, et al. 1997; Aksoylar et al., 1997; Freidman & Barton, 1990; Hunter, 1973; Kinmonth et al., 1992; Steele et al., 1970; & Teo, et al., 1998) the research teams compared acetaminophen to sponging. Acetaminophen alone was found to be more effective in reducing fever than sponging. Three of these studies (Agbolosu, et al. 1997; Aksoylar et al., 1997; Freidman & Barton, 1990) reported a significant difference, one study (Teo, et al., 1998) did not detect a significant difference, and three studies (Hunter, 1973; Kinmonth, et al., 1992; Steele et al., 1970) did not report on any significant difference (Watts et al., 2001).

Acetaminophen And Sponging Compared To Sponging

In five studies (Freidman & Barton, 1990, Hunter, 1973; Kinmonth, et al., 1992; Steele et al., 1970; Teo, et al., 1998) the research team compared acetaminophen and sponging to sponging alone. All studies reported the combination of acetaminophen and sponging to be more effective than sponging alone.

Acetaminophen and Sponging Compared to Acetaminophen

In eight studies (Freidman &, 1990; Hunter, 1973; Kinmonth, et al., 1992; Mahar, et al., 1994; Newman, 1985; Sharber, 1997; Steele et al., 1970; Teo, et al., 1998) the research team compared acetaminophen plus sponging to acetaminophen alone. While all eight studies reported that the combination of acetaminophen plus sponging was more effective in reducing fever than acetaminophen alone only four research teams (Freidman & Barton, 1990; Mahar, et al., 1994; Steele et al., 1970; Teo, et al., 1998) reported a significant difference. Three of these studies (Hunter, 1973; Newman, 1985; Sharber, 1997) reported no significant difference between the interventions; one study did not provide this information. In the groups receiving only

acetaminophen, the mean reduction of fever ranged from 0.9 degrees Celsius to 1.3 degrees Celsius.

This review, conducted by the Joanna Briggs institute (2001), identified comfort of the child, prevention of febrile seizures, parental education, and reduction of fever as outcomes. Five of the research teams measured discomfort. No statistical comparisons could be made between the studies since each used a different rating scale, and the signs assessed varied among the studies (Watts et al., 2001).

Two research teams reported a significant difference (Mahar et al., 1994; Sharber, 1997) ($p = < 0.001$, and $p = 0.009$ respectively) in the observed discomfort between the group receiving only acetaminophen and the group being sponged, another reported no significant difference in discomfort between these groups, in some studies the degree of discomfort was measured as a result of the intervention, but findings were not reported.

Prevention of febrile seizures, the second outcome measured was reported once in all the studies. No reporting of risk factors or history of febrile seizures was included in the data.

The third outcome, parental anxiety, was not measured in the 10 studies included in this review. Parents carried out the interventions: unwrapping, sponging, acetaminophen plus sponging, and acetaminophen alone. (Joanna Briggs Institute, 2001).

The objective of this review was to determine whether available evidence supported the varied nursing interventions commonly used to reduce fever, and how outcomes are influenced by these interventions (Joanna Briggs Institute, 2001). This review concluded that there is minimal benefit to sponging with only minimal decrease in temperature at the expense of the child's discomfort.

Best Practice Guidelines

Six best practice guidelines were identified in the search process; out of these three were reviewed for this project. The Joanna Briggs Institute (2001) guideline was based on a systematic review of published research. From this review, the institute addressed the issue of whether there is a need for any intervention, and when warranted whether it should be directed to decreasing the discomfort of the child. This institute also addressed the potential risks of interventions. The Joanna Briggs Institute (2001) research completed for their guideline identified fever as a major complaint in childhood. An unidentified urban hospital referred to in this guideline stated that 30 % of visits to the emergency department were children presenting with fever, however, the total number of visits in the emergency department of this hospital were not identified. Fever was recognized as an adaptive physiological response with beneficial effects (Joanna Briggs Institute, 2001; and Tejani & Zempsky, 2006).

This guideline stated "Despite its prevalence, the literature indicated that nursing management of fever in children often isn't based on research and remains inconsistent in practice" (Joanna Briggs Institute, 2001 p. 1).

The findings of these studies (Joanna Briggs Institute, 2001) were disseminated in a best practice guideline. New findings identified in this guideline relevant to the author's guideline recommendations were the need for parental education focusing on the body's physiological responses and how parents can support these responses. When contemplating interventions this guideline recommended a careful assessment of the intervention in terms of potential risk. Other recommendations include increasing the child's comfort along with interventions that support the body's physiological response to an insult such as infection. These interventions include adequate fluids, unwrapping, or removing excess clothing. This guideline identified a lack of

evidence for sponging and cautioned against administering acetaminophen to children who were dehydrated due to the potential for hepatotoxicity. The importance of a thorough medication history, individualized treatment and parental education was strongly recommended (Joanna Briggs, 2001).

In 1998 the Drug Therapy and Hazardous Substances Committee of the Canadian Pediatric Society published a review of the efficacy and safety of acetaminophen and ibuprofen in the management of fever in children. This review was utilized in the formation of the Joanna Briggs (2001) guideline. This review concluded that significant reduction of fever can occur with a single dose of acetaminophen given at 10-15 mg/kg (American Academy of Pediatrics, 1998). Further, it was identified that hepatotoxicity is most likely to occur in children two years of age or under with poor oral intake who have received oral acetaminophen every four hours at 90 mg/kg/day or greater. Additionally, the society reported that severe hepatotoxicity was reported in an unidentified Australian study and an upper limit of 60 mg/kg/day of acetaminophen was recommended (American Academy of Pediatrics, 1998; Joanna Briggs Institute 2001).

The second guideline reviewed (Baumer, 2004) was the resultant work of a group of pediatricians in the United Kingdom. This guideline replaced the sentinel guideline published by the American Academy of Pediatrics (1999), which had recommended a lumbar puncture, electroencephalograph, and various diagnostic blood work. Following a systematic review in 2002, guidelines addressed the acute presentation of a child to a secondary centre following a febrile seizure were published. Recommendations from this guideline include the following:

1. Admission for observation for two hours for all children under18 months who have had a recent antibiotic.

2. Discharge home of children have no focus of infection and parents or caregivers are capable, and access to healthcare is readily available.
3. Consider a urine sample to check for infection, and
4. Give parents a pamphlet on febrile seizures.

Guidelines published by the National Institute for Health and Clinical Excellence (2007) do not recommend antipyretics in the prevention of febrile seizures since they are not efficacious. This guideline recommends acetaminophen or ibuprofen to reduce fever and increase comfort; however, they do not recommend that acetaminophen or ibuprofen be given at the same time (2007). The guideline recommends acetaminophen or ibuprofen be considered in children who are unwell or distressed; however, they do not recommend antipyretics for the exclusive goal of reducing fever in children who are unwell or, for the sole purpose of preventing febrile seizures. Tepid sponging, under-dressing, or over wrapping of clothing are not recommended (National Institute for Health and Clinical Excellence, 2007).

Limitations of the Systematic Review

There were a number of limitations identified within this author's systematic review. The review was limited by the heterogeneity of the population. Few studies limited the age of participants from six months to five years, which was the population of focus for this project. The number of studies directly comparing acetaminophen and ibuprofen to physical methods were few. The studies within the systematic reviews and guidelines were the same with each study referencing the other. The lack of new studies presented a limitation. The lack of supported statistics was a limitation of the Watts systematic review (Watts et al., 2001) as well as the guidelines (NICE, 2007) reviewed. The numbers of guidelines located were limited with some containing outdated information.

Appendix A and B summarize the characteristics of the reviews and guidelines included in this paper.

Strengths of the Systematic Review

A number of strengths were identified with the systematic review. Meremikwu & Oyo-Ita (2004) assessed the effects of acetaminophen in treating fever in children in relation to febrile seizures and fever clearance time. Their sample size was large (n = 1509) enough to detect any differences among the groups. Seven of the studies included the population of interest to this project, children between six months and five years. Studies included RCT producing Level I evidence. The meta-analysis was conducted using relative risk with 95% confidence intervals.

Stuijvenburg (1998) studied ibuprofen compared to placebo. The cohort in this randomized, double blind trial (Level I evidence), included 230 children with at least one risk factor for febrile seizures. This cohort was randomized into either the ibuprofen group or the placebo group. This RCT utilized Kaplan-Meier curves and Cox regression for statistical analysis of the data. The intervention/control was clearly described. The results of the study were clearly addressed; of all children 67 experienced a febrile seizure recurrence. Of these, 31 were in the ibuprofen group while 36 were in the placebo group. The two-year recurrence rate was 32 and 39 percent respectively, making the recurrence risk in the ibuprofen 0.9 percent (CI_{95}=0.6-1.5) times the recurrence risk in the placebo group.

Purssell (1999) clearly stated the hypothesis that the prophylactic use of antipyretics would reduce the incidence of febrile seizures. Four studies included in the systematic review were randomized controlled trials; three were double-blinded producing Level I evidence.

Watts, Robertson, & Thomas (2001) systematic review revealed heterogeneity of the population of 821 children in ten studies. An extensive literature search was conducted including the hand search of 26 journal articles. The outcomes were clearly described.

The three guidelines included (Joanna Briggs Institute, 2001;Baumer, 2004; National Institute for clinical Excellence 2007) for this project were based on results of randomized controlled and quasi-randomized trials providing Level I and Level II evidence from which to support the guidelines. The Royal college of Pediatrics and Child Health appraised the Baumer (2004) guideline.

Chapter III

Summary of Findings

The review of the literature found that assessment to rule out major life threatening infections such as meningitis remains an important component of guidelines in the care of children presenting with febrile seizures (Baumer, 2004).

Febrile seizures were found to be a benign, yet frightening occurrence (Baumer 2004; Meremikwu & Oya-Ita, 2004; Purssell, 1999; Stuijvenberg, 1998) which cause stress and anxiety in both nurses and parents. Fever was found to be the causal agent in febrile seizures (Purssell, 2000).

The literature revealed that non-pharmacological methods such as bathing, sponging, and fanning are not effective in preventing febrile seizures and are not recommended. These interventions may in fact increase shivering causing further discomfort to the child (Baumer, 2004; Joanna Briggs Institute 2001; Meremikwu & Oya-Ita, 2004). The literature revealed no evidence to support that the combined use of pharmacological and non-pharmacological interventions prevent febrile seizures although some studies reported a significant difference in

fever reduction ((Freidman & Barton, 1990; Hunter, 1973; Kinmonth, Fulton, & Campbell, 1992; Steele, et al. 1970; Teo et al., 1998).

There is a lack of evidence in the literature that neither sustained nor intermittent pharmacological agents have been shown to be effective in preventing febrile seizures (Joanna Briggs Institute 2001; Meremikwu & Oya-Ita, 2004; Purssell, 1999). Hepatotoxicity associated with the use of acetaminophen and ibuprofen has been reported and the sustained administration of these antipyretics should be a consideration in terms of risk versus benefit (American Academy of Pediatrics, 1999; Baumer, 2004; Joanna Briggs Institute, 2001;). However, these antipyretic agents may increase the child's comfort and may be considered in children who appear uncomfortable (National Institute for Clinical Excellence, 2007).

The literature (American Academy of Pediatrics, 1999; Baumer, 2004; Joanna Briggs Institute, 2001; Purssell, 1999; Watts, et al. 2001) identified that lack of parental education regarding febrile seizures that results in increased parental anxiety This was not a variable of interest at the onset of this project, however, because its importance has been identified throughout the literature parental education related to the care of a child with febrile seizures has been added to the author's guideline recommendations.

Implications for Practice

The results of this project have important implications for community health nurses working in remote health centres in the Eastern Arctic province of Nunavut. Education of parents through anticipatory guidance, and education of community health nurses might improve the health outcomes of children who are presenting to health centres with simple febrile seizures (Baumer, 2003; Joanna Briggs Institute, 2001; Shinnar, S., & Glauser, T., 2002) and may decrease the high cost of medevacs required to transfer these children to an acute care facility.

The lack of available guidelines for community health nurses in Nunavut for the prevention and management of febrile seizure may contribute to the inconsistencies of interventions.

The timeline associated with putting out a call for a medevac can vary from one to two hours and up to four to six hours, depending on the location of the health centre and weather conditions. This was confirmed by Medevac North (Personal communication, March, 2008). Once the community health nurse makes the decision to medevac, a call is placed to the physician on call at the Baffin Regional hospital. The physician receives a report and mobilizes the medevac team; they in turn call the health centre for another report on the condition of the child. This procedure in itself may take as long as 45 minutes to one hour. Once deployed, the flight can take several hours. Medevac North (Personal communication, March, 2008). This procedure takes up valuable nursing hours. Additionally, the expense of nursing hours must be considered. If the occurrence is during clinic hours, regularly scheduled appointments are cancelled to accommodate one to one care with the child. If a medevac is required after clinic hours, there is the consideration of overtime hours of the nurse, as well as a second nurse if needed, and clerical staff. The overall expense incurred could be extremely high, especially if the child has suffered a simple febrile seizure, which might have easily been cared for in the health centre or by the parents with appropriate guidelines.

Few data are available on health services utilization and treatment costs associated with children experiencing simple febrile seizures. In the Eastern Arctic, the cost associated with a medevac depends on location and can be as high as twenty thousand dollars, Medevac North (personal communication, March, 2008). An escort, usually a parent, is required to accompany the child. In the case of a simple febrile seizure, the child is generally observed overnight and returned to the community along with the escort on the next scheduled flight. This creates an

added expense that can run as high as two thousand dollars, Medevac North (personal communication, March, 2008). The best practice guideline from the Joanna Briggs Institute (2001) identified the lack of parental education and consideration of parental beliefs and expectations when caring for a child with a febrile illness. The implications to practice based on this guideline are whether or not to intervene. The nurse should consider increasing comfort or decreasing discomfort, the clear purpose of the intervention, parental support and assessment of potential risks and benefits. Sponging was not recommended, because there was a lack of evidence that this intervention decreased fever and carried the risk of increasing discomfort (Joanna Briggs, 2001). The use of acetaminophen should be used cautiously; sustained administration is not recommended due to the potential of hepatotoxicity. Also recommended was education on the proper dosage, measuring instrument, and maximum daily doses (Joanna Briggs Institute, 2001).

The literature indicated that despite the abundance of research available regarding febrile seizures in children, nursing management remains inconsistent in practice (Joanna Briggs Institute, 2001; Watts, et al. 2001). Additionally, the lack of parental knowledge, unfounded fears, and, misconceptions lead to inappropriate clinic and hospital visits (Joanna Briggs Institute, 2001). All of these findings have important implications for community health nurses working in remote northern communities of Nunavut.

Implications for further Research

Several studies recommended parental education in the management of children at risk of or experiencing a simple febrile seizure. It would be relevant for future research to assess outcomes, such as decreased health centre visits and appropriate care by parents following parental education to parents living in remote communities in the Eastern Arctic. Further research based

studies looking at how the quality of life in Inuit families with children prone to febrile seizures is impacted, and what difference parental education might have on the impact would be of interest to community health nurses working in northern remote regions of Nunavut.

The commonality of aggressively prescribing acetaminophen and ibuprofen over an extended period as a prophylactic treatment for prevention of febrile seizures and fever requires additional studies to evaluate harmful effects to vital organs, particularly to the liver.

Further research into the genetic association of febrile seizures in first and second-degree relatives might be beneficial to health care professionals when educating families with high-risk children.

Further research studies to assess the impact of change on the practice of community health nurses in these remote health centres might be beneficial. This may result in decreased nursing costs as well as decreasing the high cost of a medevac.

Further study on the Stetler Model to determine its effectiveness on supporting and promoting changes in practice in remote health centres would be relevant and of interest to community health nurses working in these areas. The Stetler Model is grounded in the utilization of research evidence (Stetler, 2001). This Model guides the change process through specific steps as previously discussed. Whether these steps are effective in creating a change in practice in remote settings might be beneficial to future utilization of research findings.

Chapter IV

Recommendations

Guidelines that address the prevention of febrile seizures need to be developed for community health nurses working in remote health centres in the Eastern Arctic. Development of guidelines might promote consistency of care and improve patient outcomes. A lack of current

guidelines regarding the interventions used in the management of febrile seizures contributes to the use of varied and inconsistent intervention practices in the Eastern Arctic in the treatment of childhood febrile seizures. It is the author's opinion that the results of the systematic review conducted for this project indicate that educating practitioners regarding the pathophysiology, the benign nature of febrile seizures, and other prevention modalities might accomplish the following: provide continuity of care, reduce the use of inconsistent, ineffective, and potentially harmful interventions such as bathing, fanning, and sustained pharmacological treatment. This in turn might reduce the high cost of health care utilization and improve the outcome of children who are experiencing or who are at risk for febrile seizures. These guidelines should be specific to community health nurses practicing in remote health centres in the Eastern Arctic province of Nunavut and include evidence-based recommendations for the use of antipyretics, diagnostic tests, and parental education when caring for a child with simple febrile seizures.

Anticipated goals when introducing guidelines are to promote a change of practice through the education of practitioners and parents in the care of children who are presenting with, or who are at risk of, febrile seizures. The anticipated goal of identification of those children at risk because of previous febrile seizures or family history of febrile seizures might also promote a change of practice by offering anticipatory guidance to parents rather than offering inconsistent or ineffective and potentially harmful interventions.

From this author's review of the literature it is apparent that guidelines must contain information that will guide the clinician in assessment of potentially life threatening conditions in children such as meningitis. The decision of when to seek further medical advice or to medevac the child is an essential element of the assessment. Risk factors, another essential element of the guidelines can be elicited from an in-depth history and guide the community

health nurse in developing a differential diagnosis to distinguish between potentially life threatening conditions, a complex febrile seizure or whether further medical advice or a medevac will be anticipated. The etiology and pathophysiology should be briefly outlined in the guidelines as well as a rational management approach. Information given to parents should be specific regarding which interventions are recommended, which should be avoided, and when to bring the child to the health centre. It is suggested that if information is provided to parents before the first febrile seizure the anxiety level may be decreased enabling more appropriate reactions (Flury, et al. 2001). As with all guidelines it is suggested that a timeframe for review be established; they guidelines should contain interventions that are current and evidence-based.

Dissemination of Evidence

This project will be presented to the University of Northern British Columbia Family Nurse Practitioner project examining committee. Guideline recommendations will be distributed to the First Nations and Inuit Health Branch (FNIHB) of Health Canada, the governing health care body in Nunavut.

The use of the Stetler Model focuses on assisting groups of nurses with research utilization. By implementing the steps of research utilization outlined in the Stetler Model, (2001) preparation, validation, and comparative evaluation the recommendations may be integrated into the FNIHB guidelines. The decision making, application, and evaluation would be for FNIHB to develop a quality assurance protocol to monitor and assess the recommendations, as well as to develop educational programs for the community health nurses working in remote Eastern Arctic communities.

Phase IV of the Stetler Model, (2001) the decision phase, is the time when knowledge is either put into practice or rejected. Guided by this phase of the Stetler Model (2001)

implementation of recommended guidelines by FNIHB might impact the decision by community health nurses as to which interventions to consistently use in caring for children with febrile seizures. Since the results of this systematic review identified ineffective and potentially harmful interventions used in the management of febrile seizures, an organizational decision by FNIHB to implement guidelines may promote better adherence to the recommendations.

Potential obstacles to adoption of the findings by community health nurses may arise because of lack of knowledge of research utilization. This might be addressed by education regarding research based nursing and utilization of evidence into practice. According to Stetler, (1994) involvement leads to enlightenment (i.e., the way one thinks about situations and interventions after reading research) (Stetler, 1994). A major facilitating factor to overcome potential obstacles might be managerial support from nurse managers and nursing officers. Nurse managers work closely with the health centre in day-to-day operational issues; they also have a voice when policy and guideline implementation decisions are made to ensure standardized care in health centres, (Stetler, 1994) because of this role they would be the likely candidates to facilitate change. Another facilitating factor might be the desire of nurses to provide knowledgeable evidence based care with the anticipated outcome of improving care to this pediatric population.

Anticipated goals from the dissemination of findings from this project would include: educating community health nurses and parents on the pathophysiology and benign nature of febrile seizures in order to recognize and care for a child presenting with simple febrile seizures, consistent interventions being used in the management of febrile seizures, and a decreased number of unnecessary and costly medevacs.

In the future it is hoped that development of a fact sheet on the management and febrile seizures for parents be translated into Inuktitut, the official language of Nunavut for distribution to remote health centres in the Eastern Arctic.

Furthermore a manuscript of this project may be submitted for publication. Submission possibilities may include, Epi-North, The Canadian Nurse, as well as a professional pediatric journal to capture a wide audience of colleagues.

The author is a member of the Northern Nurses Leadership Network (NNLN) and as such, the findings of this project will also be distributed to this committee for possible implementation into clinical practice guidelines. The NNLN is a group of northern nurses in management and leadership roles that are responsible for the formulation, examination, and recommendation of policy, procedures, and practices in communities in the north. It is anticipated the findings of this project will be implemented into clinical practice guidelines in community based health centres in the north.

Conclusion

The potential exists for community health nurses working in the Eastern Arctic communities of Nunavut to decrease the costly and often unnecessary medevacs of children having had a febrile seizure and to realize a change of practice to utilize consistent, effective interventions when caring for these children who present to the health centres. Use of the Stetler Model to facilitate this change of practice may be the catalyst. The Stetler Model acts as a structure for evaluating the appropriateness, feasibility, and manner of using research findings in an individual or group practice. The six activity phases of the Stetler Model are preparation, validation, comparative evaluation, decision-making, translation/application, and evaluation (Stetler, 2001).

This systematic review found that pharmacological interventions have not been shown to be effective in preventing febrile seizures but are recommended to relieve discomfort. Sustained administration of antipyretics is not supported to prevent febrile seizures and has the potential to cause harm (Baumer, 2004; Meremikwu & Oyo-Ita, 2004; Purssell, 1999; Stuijvenberg, 1998; Watts, et al., 2001). Multiple researchers found the administration of ibuprofen and acetaminophen to be effective in reducing fever; however, the evidence was insufficient. Furthermore, the systematic review found that evidence supports the conclusion that the use of these antipyretics will not prevent the recurrence of febrile seizures. Febrile seizures are relatively benign and have an excellent prognosis; as such, the use of anticonvulsants with their potential side effects do not outweigh the benefits and are not recommended routinely or intermittently (American Academy of Pediatrics, 1999). Evidence does not support non-pharmacological methods such as bathing, sponging and fanning reduce the recurrence of febrile seizures is insufficient. Additionally, evidence suggests these methods may increase the discomfort of the child and should be used with caution. Sponging increases discomfort, and may initiate shivering that in turn can increase the temperature additionally; it is a poor utilization of nursing time for an ineffective intervention. Evidence suggests that fever, as a common immunological response to infection, may be beneficial during an illness, and as such, no intervention may be needed (Joanna Briggs Institute, 2001; Tejani & Zempsky, 2006).

Parent's knowledge of febrile seizures is insufficient and methods to better educate them needs to take place. Educating parents may decrease the anxiety and stress they experience when their child has had or is at risk of febrile seizures (American Academy of Pediatrics, 1999; Purssell, 1999). Flury, Aebi, & Donati, (2001) suggest that education given to parents of a child at risk of febrile seizures or having a history of febrile seizures prior to their occurring might

reduce anxiety and promote appropriate interventions when parents are dealing with febrile seizures.

The literature confirms that various health practices exist that attempt to prevent febrile seizures, however, evidence suggests that they are not preventable and suggests rather the recognition of the risk factors for their occurrence. Stuijvenberg (1998) identified the following risk factors for the recurrence of febrile seizures as:

1. First-degree family member with a history of febrile seizure
2. Temperature of < 40 degrees Celsius at the initial febrile seizure
3. Previous recurrence of febrile seizure

Although risk factors can be readily identified, a child with one risk factor may be just as susceptible to having a febrile seizure as a child with all of the risk factors. This would present an unnecessary worry to parents whose child, while having a risk factor, is still unlikely to suffer a febrile seizure.

The fact that febrile seizures in childhood are common with excellent outcomes does not negate the fact that parents find them frightening, traumatic, and anxiety and stress provoking, often with the perception that their child might die. There have been no deaths associated with febrile seizures in developed countries (Jones & Jacobsen, 2007).

Guidelines of care based on research may improve outcomes for children at risk of, or having febrile seizures, and may promote a change of practice that would eliminate the inconsistencies of interventions currently seen in practice.

References

Agbolosu N. B., Cuevas, L. E., Milligan, P., Broadhaed, R. L., Brewster, D., & Graham, M. (1997). Efficacy of tepid sponging versus paracetamol in reducing temperature in febrile children. *Annals of Tropical Paediatrics,* (17), 283-288.

Aksoylar, S., Aksit, S., Caglayan, S., Yapark, I., Bakiler, R., & Cetin, F. (1997). Evaluation of sponging and antipyretic medication to reduce body temperature in febrile children. *Acta Paediatrica Japonica* (39), 215-217.

American Academy of Pediatrics. (1996). Practice parameter: The neurodiagnostic evaluation of the child with a first simple febrile seizure. *Pediatrics, 97*(5), 769-771.

American Academy of Pediatrics. (1998). Acetaminophen and ibuprofen in the management of fever and mild to moderate pain in children. *Pediatrics & Child Health, 3*(4).

American Academy of Pediatrics. (1999). Practice parameter: Long-term treatment of the child with simple febrile seizure. *Pediatrics,* 103(6), 1307-1309.

Baumer, J. (2004). Evidence based guideline for post-seizure management in children presenting acutely to secondary care. *Archives of Disease in Childhood, 89*, 278-280.

Beyea, S., & Nicoll, L. (1997). Research utilization models help disseminate research findings and ultimately improve patient outcomes. *AORN, 65*(3), 640-642.

Camfield, P. R., Camfield, C. S., Shapiro, S. H., & Cimmings, C. (1980). The first febrile seizure-antipyretic instruction plus either phenobarbitol or placebo to prevent recurrence. *Journal of Pediatrics,* (97), 16-21.

Crocetti, M., Moghbeli, N., & Serwint, J. (2001). Fever phobia revisited: Have parental misconceptions about fever changed in 20 Years? *Pediatrics, 107*(6), 1241-1246.

Daoud, A. (2003). Febrile convulsion: review and update. *Journal of Pediatric Neurology, 2*(1), 9-14.

Dow, J. A. T, & Lackey, J. M. (Eds.) (1999). Dictionary of Cell Molecular Biology (third ed.). London: Academic Press.

El-Radhi, A. S., & Banajeh, S. (1989). Effect of fever on recurrence rate of febrile convulsions. *Archives of Disease in Childhood* (64), 869-870.

Esch, A., Moll, H., Offringa, M., Hoes, A., Habbema, J., & Derksen-Larsen, G. (2000). A study of the efficacy of antipyretic drugs in the prevention of febrile seizure recurrence. *Ambulatory Child Health, 6*, 19-26.

Flury, T., Aebi, C., & Donati, F. (2001). Febrile seizures and parental anxiety: does information help? *Swiss Med Weekly, 131*, 556-560.

Freidman, A., & Barton, L. (1990). Efficacy of sponging vs acetaminophen for reduction of fever. *Pediatric Emergengy Care, 6*(1), 6-7.

Graneto, J. (2006). Pediatrics, fever. Retrieved October 24, 2007 from http://www.emedicine.com/EMERG/topic377.htm.

Hampers, L., Thompson, L., Bajaj, L., Tseng, B., & Rudolph, J. (2006). Febrile seizure: Measuring adherence to AAP Guidelines among community ED Physicians. *Pediatric Emergency Care, 22*(7), 465-469.

Hulshof, C., & Hoenen, J. (2006). Evidence-based practice guidelines in OHS: Are they AGREE-able? *International Congress Series, 1294*, 7-11.

Hunter, J. (1973). Study of antipyretic therapy in current use. *Archives of Disease in Childhood,* (48), 313-315.

International League Against Epilepsy. (1989). Retrieved November 11, 2007 from http://www.ilae-epilepsy.org/.

Joanna Briggs Institite. (2001). Management of the child with fever. *Best Practice, Evidence Based Practice Information Sheets for Health Professionals, 5*. Retrieved November 5, 2006 from www.joannabriggs.edu.au.

Jones, T., & Jacobsen, S. (2007). Childhood febrile seizures: Overview and implications. *International Journal of Medical Sciences, 4*(2), 110-114.

Kinmonth, A. L., Fulton, Y., & Campbell, M. (1992). Managenent of feverish children at home. *British Medical Journal,* (305), 1134-1136.

Kramer, M., Naimark, L., Roberts-Brauer, R., McDougall , A., & Leduc, D. (1991). Risks and benefits of paracetamol antipyresis in young children with fever of presumed viral origin. *Lancet, 337*, 591-594.

Mahar, A., Allen, S., Milligan, P., Suthminirund, S., Cholpitayasunondh, T., Sabchaeron, A., et al. (1994). Tepid sponging to reduce temperature in febrile children in tropical climate. *Clinical Pediatrics, 33*, 227-231.

Melnyk, B. M., & Fineout-Overholt, E. (2005). *Evidence-Based practice in nursing & healthcare: A Guide to Best Practice.* Phildelphia: Lippencott Williams & Wilkins.

Meremikwu, M., & Oyo-Ita, A. (2004). Paracetamol for treating fever in children. Retrieved November 6, 2006 from http://library.unbc.ca:3057/gwl/ovidweb.cgi.

Mosby's Medical Dictionary (7^{th} ed.) (2006). St. Louis, Missouri: Elsevier.

National Institute for Health and Clinical Excellence. (1980). *Long-term management of children with fever associated seizures.*

National Institute for Health and Clinical Excellence. (2007). *Feverish illness in children; Assessment and initial management in children younger than 5 years.*

National Institute of Health. (2008) National Heart, Lung, & Blood Institute. *About clinical practice guidelines.* Retrieved May 9, 2008 from www.nhibi.nih.gov/guidelines/about.htm.

Purssell, E. (2000). The use of antipyretic medications in the prevention of febrile convulsions in children. *Journal of Clinical Nursing, 9*, 473-480.

Sadleir, L., & Scheffer, I. (2007). Febrile seizures. *British Medical Journal, 334*, 307-311

Schnaiderman, D., Lahat, E., Sheerer, T., & Aladjem, M. (1993). Antipyretic effectiveness of acetaminophen in febrile seizures: ongoing prophylaxis versus sporadic usage. *European Journal of Pediatrics, 152*, 747-749.

Sharber, J. (1997). The efficacy of tepid sponge bathing to reduce fever in young children. *American Journal of Emergency Medicine, 15*(2), 188-192.

Shinnar, S., Glauser, T. (2002) Febrile seizures. *Journal of Childhood Neurology. 17, S44-S52.*

Steele, R. W., Tanaka, P. T., Lara R. P., & Bass, J. W. (1970). Evaluation of sponging and of oral antipyretic therapy to reduce fever. *Journal of Pediatrics, 77*(5), 824-829.

Stetler, C. (1994). Refinement of the Stetler/Marram model for application of research findings to practice. *Nursing Outlook, 42*, 15-25.

Stetler, C. (2001). Updating the Stetler Model of research utilization to facilitate evidence-based practice. *Nursing Outlook, 49*, 279-279.

Stuijvenberg, M., Derksen-Lubsen, G., Steyerberg, E., Habbema, J., & Moll, H. (1998). Randomized controlled trial of ibuprofen syrup administered during febrile illness to prevent febrile seizure recurrences. *Pediatrics, 105*(5).

Sunami, K., Hayashi, N., & Endo, S. (1990). A twin study of febrile convulsions in the general population. *Japanese Journal of Psychiatry and Neurology, 42*, 549-551

Tejani, N., & Zempsky, W. (2006). Pediatrics, febrile seizures. Retrieved July 23, 2007 from http://www.emedicine.com/EMERG/topics376.htm.

Teo, J., Rahim, N., Fong, V., Koon, S., Mai, T., & Yap, J. (1998). *Tepid sponging as part of pediatric fever management*. Paper presented at the Inaugural Asia-Pacific Nursing Scientific Meeting.

Thiessen, R. (2006). *Recurrent febrile seizures.* Paper presented at the St. Paul's Hospital CME, Vancouver, BC.

Tierney, L. M., McPhee. S. J., & Papadakis. M. A. (Eds.) (2006). *Current medical diagnosis and treatment* (45th ed.). Toronto: McGraw Hill.

University of Minnesota, (2000). Minneapolis. Evidence- Based Health care Project. *Evidence based nursing*. Retrieved October 27, 2007 from http://evidence.ahc.umn.edu/ebn.htm.

Verity, C. M., Greenwood, R., & Golding, J. (1998). Long-term intellectual and behavioral outcomes of children with febrile convulsions. *New England Journal of Medicine, 24*, 1723-1728.

Waruiru, C., & Appleton, R. (2004). Febrile seizures: An update. *Archives of Disease in Childhood 89*, 751-756

Watts, R., Robertson, J., Thomas, G., & Panel, R. (2001). The nursing management of fever in children: A systematic review. Retrieved November 6, 2006, from www.joannabriggs.edu.au.

Appendix A

Randomized Control Trials Systematic Review Analysis

Authors	**Meremikwu 2004**	**Stuijvenberg 1998**	**Purssell 1999**	**Watt 2001**
Title	Acetaminophen for treating fever in children.	Randomized, controlled trial of ibuprofen syrup administered during febrile illness to prevent febrile seizure recurrences.	The use of antipyretic medications in the prevention of febrile seizures.	Nursing management of fever in children a systematic review.
Conceptual Theoretical Framework	None Indicated	None indicated	None indicated.	None indicated.
Study Design	Systemic review of RCT Quasi-RCT	Randomized double blind placebo-controlled trial.	Narrative Review.	Systematic review of RCT and Quasi-RCT.
Variables Studies	Acetaminophen Fever Febrile seizure	Ibuprofen Placebo Febrile seizure, rectal temperature.	Antipyretic medications Febrile seizures.	Antipyretics Sponging Reduction of or prevention of increase in fever.
Sample Description	Children with fever comparing: 1) acetaminophen with placebo or no treatment; 2) acetaminophen with physical cooling methods.	230 children, between Oct 1, 1994 and April 1, 1996, 1-4 years of age with at least one risk factor for febrile seizure recurrence randomly assigned to placebo or treatment arms.	5 studies all considered use of antipyretics in children with first febrile seizure in 2 studies. One study looked at children with previous seizure with risk factor for recurrence. One study followed children seen for routine examinations and one study looked at children with simple febrile seizures; it was not identified if these were the first. All studies followed children birth to 6 years of age.	Ten studies with a total number of children of 821 between the age of 3 months and 16 years.
Measurement Instruments	Each study in this systematic review	Philips HP5316 digital rectal thermometer.	The studies retrieved were a very heterogeneous collection. Qualitative	Each study utilized varying measurement instruments in the

Authors	**Meremikwu 2004**	**Stuijvenberg 1998**	**Purssell 1999**	**Watt 2001**
per Variable	utilized varying measurement instruments in the development of methodology.		analysis was not appropriate and a narrative review was done.	development of methodology.
Data Analysis Used	RR with 95% CI for discrete variables and weighted mean differences for continuous outcomes.	Kaplan-Meier curves and Cox regression were used for the statistical analysis. Intention to treat analysis.	Due to the heterogeneous collection the authors state it was not appropriate to subject them to quantitative analysis.	Data extraction form developed and pilot tested. Categories of extraction were participant characteristics, interventions & outcomes. Heterogeneity precluded meta-analysis. Narrative comparisons provided.
Study Findings	This Systematic review has not demonstrated convincing evidence that acetaminophen is effective in reducing fever in children or preventing febrile seizures.	This study concluded that no evidence exists to support intermittent antipyretics treatment to prevent febrile seizure recurrences. Antipyretics may be given during a febrile illness for comfort.	Antipyretics appear to have no effect in the prevention of FS in children.	Results suggest little if any benefit from sponging. Risk of administering antipyretics on sustained basis and above a low total daily dosage identified. Lack of evidence in literature that administering antipyretics reduces the incidence of febrile seizures. The need for parental education identified.
Study Strengths	Studies included were RCT or Quasi-RCT. Homogenous with respect to demographics and outcomes measured. Reasons for	Analysis by intention to treat Intervention/control clearly described. Randomization successful with similar characteristics at baseline. Random allocation of interventions. Sufficient information of	Hypothesis clearly stated. Computerized databases searched.	RCT & Quasi-RCT Level I evidence. Extensive literature search. Extensive hand search of (26) journals. Selection criteria clearly described. Outcomes clearly described.

Authors	**Meremikwu 2004**	**Stuijvenberg 1998**	**Purssell 1999**	**Watt 2001**
	exclusion noted. If doubt existed as to inclusion a consult to the Cochrane Infectious Disease Group editor was made.	inclusion/exclusion criteria included.		Check sheet for quality of qualitative studies utilized. Subgroups removed.
Study Weaknesses	It appears this SR meets quality measurements of a quality review.	Randomization allocation characteristics showed 67% and 78% of the sample were Caucasian. High loss to follow-up, 230 original number and 140 stated as final number with no mention of similarity in demographics of those lost to follow-up.	Heterogeneity of the five studies. Small sample size of 5 studies in the review. No studies were excluded. No data analysis. Only three databases searched. No identification of search terms used. Interventions not similar between studies.	Lack of reported basic statistics required for a meta-analysis a major impediment. Brief description of excluded studies

Appendix B

Best Practice Guidelines

Source/date of publication	**Joanna Briggs Institute 2001**	**Baumer, J. H., 2004**	**National Institute for Clinical Excellence 2007**
Title	Management of the child with fever.	Evidenced based guideline for post-seizure management in children presenting acutely to secondary care.	Feverish illness in children.
Scope and purpose	To determine whether available evidence supported types and timing of nursing interventions commonly used to reduce fever. Nursing interventions influenced the outcomes. The specific question of whether the available evidence in terms of outcome support the nursing interventions commonly used to reduce fever in non-critically ill children.	The increased rates of hospital admissions among children following seizures prompted this group to look at the variables of admission and management. A group of pediatricians completed an evidence-based guideline on the management of these children in the hopes of decreasing hospital admissions.	Designed to assist healthcare professionals in the assessment and treatment of children presenting with fever by offering best practice advice.
Stakeholder involvement	Review of literature by the Western Australian Centre of Evidence Based Nursing and Midwifery (WACEBNM) with the involvement of a review panel of experts.	A Delphi consensus process was used to provide clinical expertise and assist where evidence was weak or lacking. A group of professional panelists were utilized, their identities were not revealed to participants.	A Delphi consensus process was used to provide clinical expertise and assist where evidence was weak or lacking. A group of professional panelists were utilized, their identities were not revealed to participants
Rigor of development	Guideline based on the	Guideline based on systematic	Systematic searches

Source/date of publication	**Joanna Briggs Institute 2001**	**Baumer, J. H., 2004**	**National Institute for Clinical Excellence 2007**
	systematic review of literature published by the Joanna Briggs Institute. Criteria for selecting evidence clearly described. Methods used for formulating recommendations clearly described. Results grouped by outcome, health benefits, comfort/discomfort, hepatotoxicity, FS prevention and parental anxiety.	review. Panelists were professional and their identity concealed. Panelist responses were fed back to participants three times to achieve consensus to a predefined degree of agreement. The target users of the guideline are clearly defined. A panel of parents piloted the information literature. Recommendations are graded A to D and linked to four levels of evidence using a system developed by the Scottish Intercollegiate Guideline Network. (SIGN) The Royal College of Pediatrics and child Health appraised the guideline.	conducted using Ovid, CINAHL, and the Cochrane Database of Systematic Reviews and published evidence.
Clarity & presentation	Recommendations based on outcomes. Key recommendations easily identifiable.	The guideline is easy to read. Key points are bulleted making them clearly identifiable. Recommendations are specific.	Recommendations based on evidence derived from Level I, II studies.
Application	Organizational barriers were not mentioned. Implications of cost are not applicable to the interventions. There are	The potential organization barriers were not discussed. Cost of applying the measures were merely mentioned by the	Barriers were not discussed. Cost of applying measures was not mentioned.

Source/date of publication	**Joanna Briggs Institute 2001**	**Baumer, J. H., 2004**	**National Institute for Clinical Excellence 2007**
	sufficient key review criteria for auditing purposes. Literature is listed in the SR used in the development of this guideline.	rate of hospital admissions. A review criterion is available for monitoring the guideline.	
Editorial independence	The independence of the guideline is not known. No conflict of interest of the members of the guideline development was noted.	The funding of this is unknown. Published by a group of physicians in the Archives of Disease in Childhood.	Funding methods were not mentioned.

Appendix C

Recommendations for guidelines

Febrile Seizures

It is recommended that guidelines be implemented to assist the community health nurse in decision-making in the management of children presenting to health centres in remote northern communities with simple febrile seizures. It is recommended that guidelines are meant as a guide and should not override the clinical judgment of individual cases.

Definition

A seizure occurring in a child from age six months to five years precipitated by fever arising from outside the central nervous system in an otherwise healthy child. Simple febrile seizures last < 15 minutes, occur once in a 24-hour period, and are generalized. Simple febrile seizures are usually benign, that is they are not a threat to life or long-term health, are harmless in effect and are self-limiting with an excellent prognosis. Febrile seizures account for 80 percent of all seizures in this age group. Conversely complex febrile seizures last > 15 minutes, occur more than once in 24 hours and are generally focal in nature.

Risk Factors

The risk of a febrile seizure increases if there is a history of siblings or other family members having experienced a febrile seizure If a child has had a previous febrile seizure the risk of recurrence is higher Fifty percent of children will have no risk factors.
History of recent immunization
History of recent viral or bacterial illness.

Pathophysiology

Simple febrile seizures occur at a time of development when there is a low threshold to childhood infections such as viral infections, otitis media, and respiratory infections. The child responds to these infections with high temperatures as a result of the cytokine network. Viral illnesses are the predominant cause of febrile seizures.

History

A detailed history is essential to rule out central nervous system infections such as meningitis, encephalitis, and sepsis.
Family history.
History of previous febrile seizure.
Was the seizure witnessed? If so elicit the following:

- What time did it start
- how long did it last
- was it generalized or focal

Any recent or remote history of head trauma.
Recent antibiotics.
Recent immunizations.
Chronic medical conditions.
History developmental delays.
Birth history.
History of the fever.
Recent feeding patterns.
Possibility of ingestion of toxic substance.

Physical Exam

Assess general appearance, mental status, (e.g. lethargy) interaction and response with parent.
Assessment of airway, breathing, circulation and level of consciousness.
Assess vital signs, respiratory rate, heart rate, and capillary refill time.
Body temperature.
Neurological examination

Assess for evidence of meningitis: Including but not limited to:
- nuchal rigidity
- bulging fontanels
- lethargy
- Kernig's sign
- Brudzinski's sign
- Irritability

Assess for source of fever: Including but not limited to:
- otitis media
- tonsillitis
- urinary tract infection
- lower respiratory tract infection

Hydration status
Erythematous, macular rash
Signs suggesting trauma

Interventions
Tepid bathing or sponging is not recommended in the prevention of febrile seizures and evidence suggests it may increase shivering adding to the child's discomfort.
Insufficient evidence exists that fanning will decrease the recurrence of febrile seizures.
Do not under dress or over wrap.
There is no evidence to support prolonged or intermittent use of antipyretics to prevent recurrence of febrile seizures.
Acetaminophen or ibuprofen can be given to increase comfort of the febrile child and may decrease fever. Dosage should not exceed 60 mg/kg per day (American Academy of Pediatrics, 1998; Joanna Briggs Institute 2001). These antipyretics do not prevent febrile seizures and should not be administered for that reason.
Administration of antipyretics should not be sustained. Evidence suggests that a one-time dose is effective in decreasing discomfort.
Consider finger prick blood glucose if child seizing at time of presentation.
Consider urine sample to rule out urinary tract infection.
Children < 18 months should be admitted and observed for two hours.
Consult with physician for any child < 4 months or any indications of neurological involvement.
Children with no focus of infection may be discharged home if parents are capable and access to the health centre is readily available.

General Comments
Good communication between the nurse and parents is essential. Parents should be given the opportunity to make informed decisions in partnership with the nurse about their child's care & treatment.

Parental Education
Anticipatory guidance should be given to parents of children with a risk factor of febrile seizures (Flury et al. 2001). Discuss the following with parents:
- identification of risk factors
- offer regular fluids
- assess for signs of dehydration
- assess for skin rash
- when to contact health center
- correct dosage of antipyretic
- care during a seizure